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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/657,055	09/07/2000	Noriaki Fukiage	08038.0024	1805

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EXAMINER	
VU, HUNG K	

ART UNIT	PAPER NUMBER
2811	

DATE MAILED: 11/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/657,055	FUKIAGE, NORIAKI	
	Examiner	Art Unit	
	Hung K. Vu	2811	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 July 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13,15-18* is/are pending in the application.

4a) Of the above claim(s) *6-13* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,5 and 15* is/are rejected.

7)☒ Claim(s) *2-4 and 16-18* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 5 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lopatin (PN 6,144,096, of record) in view of Gesheva et al. (Article, of record).

Lopatin discloses, as shown in Figure 4, a semiconductor device comprising,

an insulator film (116,117,108) formed on a substrate (100);

a wiring layer of copper (206) formed proximate the insulator film;

a cobalt layer (208) formed between the insulator film and the wiring layer.

Lopatin does not disclose a crystalline film containing tungsten, carbon and nitrogen between the insulator and the cobalt layer. However, Gesheva et al. discloses a crystalline barrier film that has a material containing tungsten, carbon and nitrogen is used as diffusion barrier for cobalt. Note page 88, section 3 of Gesheva et al.. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the device of Lopatin having the crystalline film containing tungsten, carbon, and nitrogen between the insulator and the cobalt layer, such as taught by Gesheva et al. in order to prevent the diffusion of cobalt and the wiring into the insulator film.

Allowable Subject Matter

2. Claims 2-4 and 16-18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

3. The following is an examiner's statement of reasons for allowance:

Applicant's claims 2-4 and 16-18 are allowable over the references of record because none of these references disclose or can be combined to yield the claimed device comprising the crystalline film having the properties as claimed.

Response to Arguments

4. Applicant's arguments filed 07/23/03 have been fully considered but they are not persuasive.

It is argued, at pages 3-5 of the Remarks, that there is no suggestion or motivation in either Lopatin or Gesheva et al. to combine or modify the asserted teachings of the references. This argument is not convincing because Lopatin teaches all of the claimed limitation except the crystalline film containing tungsten, carbon and nitrogen between the insulator and the cobalt layer. Gesheva et al. teaches a crystalline barrier film that has a material containing tungsten, carbon and nitrogen is used as diffusion barrier for cobalt. Note page 88, section 3 of Gesheva et al.. So one skill in the art would be motivated to combine the teaching of Gesheva et al. into the Lopatin's device to prevent the diffusion of cobalt and subsequently the wiring into the insulator film. Note that the test for obviousness is not whether the features of a secondary reference may

be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981).

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

It is argued, at page 5 of the Remarks, that the cobalt adhesion layer of Lopatin is an optional element and since it causes a diffusion problem, one skill in the art should not incorporate the cobalt adhesion layer into the device. This argument is not convincing because there is the advantage to incorporated the cobalt adhesion layer into the device to improve the adhesion between the wiring layer and the insulation layer.

It is argued, at pages 5-6 of the Remarks, that the Examiner's proposed modification of Lopatin would destroy the objective of minimizing the barrier layer thickness, as there is a need for minimizing the size of the semiconductors. This argument is not convincing because the

objective of Lopatin is to form the barrier layer (204) in alloy with a small amount of a group V B or VI B element to increase barrier effectiveness and lower resistivity. The Examiner does not change the thickness of the barrier layer (204).

It is argued, at page 6 of the Remarks, that there is not teaching that a WcxNy film of Gesheval et al. would prevent the diffusion of the wiring material into the insulator film. This argument is not convincing because the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988)and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, one skill in the art would be motivated to combine the teaching of Gesheva et al. into the Lopatin's device to prevent the diffusion of cobalt and subsequently the wiring material into the insulator film.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hung K. Vu whose telephone number is (703) 308-4079. The examiner can normally be reached on Mon-Thurs 6:00-3:30, alternate Friday 7:00-3:30, Eastern Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (703) 308-1690. The Central Fax Number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Vu

October 31, 2003

Hung Vu

Patent Examiner